What is claimed is:

1. A method of substrate modeling, comprising:

determining scalable Z parameters associated with at least two substrate contacts;

constructing a matrix of the scalable Z parameters for the at least two substrate contacts; and

calculating an inverse of the matrix to determine resistance values associated with the at least two substrate contacts.

2. The method of claim 1, wherein the number of contacts is N, and the matrix is an $N \times N$ matrix.

3. The method of claim 1, wherein the substrate is a heavily doped substrate.

4. The method of claim 1, wherein the substrate is a lightly doped substrate.

5. The method of claim 1, wherein, for a first contact and a second contact of the at least two contacts, the determining comprises:

dividing the first contact into smaller portions; and

determining respective Z parameters between the smaller portions and the second contact.

6. The method of claim 5, wherein the smaller portions are rectangular or square portions.

7. The method of claim 1, wherein, for a first contact and a second contact of the at least two contacts, three scalable Z parameters are determined.

8. The method of claim 7, wherein a first of the scalable Z parameters is a ratio of an open-circuit voltage at the first contact to an input current at the first contact, a second of the scalable Z parameters is a ratio of an open-circuit voltage at the second contact to an input current at the second contact, and a third of the scalable Z parameters is a ratio of an open-circuit voltage at the first contact to a source current at the second contact.

9. The method of claim 1, wherein at least one of the scalable Z parameters is a function of contact area and contact perimeter.

10. The method of claim 1, wherein at least one of the scalable Z parameters is a function of contact geometry and contact separation.

11. The method of claim 1, wherein the scalable Z parameters comprise a first set of scalable Z parameters associated with resistances between the at least two substrate contacts and a groundplane and a second set of scalable Z parameters associated with cross-coupling resistances between the at least two substrate contacts.

12. The method of claim 11, wherein the scalable Z parameters of the first set are based on a first model equation and the scalable Z parameters of the second set are based on a second model equation.

13. The method of claim 12, wherein the first model equation is

$$Z = \frac{1}{K_1 Area + K_2 Perimeter + K_3},$$

wherein Z is a ratio of an open-circuit voltage to input current for a selected contact with other contacts being open circuits, *Area* is an area of the selected contact, *Perimeter* is a perimeter of the selected contact, and K_1, K_2, and K_3 are parameters that are dependent on substrate properties.

14. The method of claim 13, wherein K_1, K_2, and K_3 are determined by curve fitting based on a simulation or a measurement.

15. The method of claim 12, wherein the substrate is a lightly doped substrate, and the first model equation is

$$Z = \frac{1}{K_1 Perimeter + K_2},$$

wherein Z is a ratio of an open-circuit voltage to an input current for a selected contact with other contacts being open circuits, *Perimeter* is a perimeter of the selected contact, and K_1 and K_2 are parameters that are dependent on substrate properties.

16. The method of claim 15, wherein K_1 and K_2 are determined by curve fitting based on a simulation or a measurement.

17. The method of claim 12, wherein the second model equation for a selected pair of contacts having a fixed relative position y is

$$Z = \alpha e^{-\beta x},$$

wherein Z is a ratio of an open-circuit voltage at a first contact to a source current at a second contact, x is a separation between the first contact and the second contact, α is a value of Z when x is zero, and β is a parameter that is dependent on substrate properties.

18. The method of claim 17, wherein the first contact and the second contact of the selected pair of contacts have a same contact size.

19. The method of claim 17, wherein β is determined by curve fitting based on a simulation or a measurement.

20. The method of claim 12, wherein the second model equation for a selected pair of contacts having a fixed separation x is

$$Z = ay^2 + by + c,$$

wherein Z is a ratio of an open-circuit voltage at a first contact to a source current at a second contact, y is a relative position between the first contact and the second contact, and a, b, and c are scalable parameters that substantially depend on contact dimensions.

21. The method of claim 20, wherein a size of the first contact is different than a size of the second contact.

22. The method of claim 20, wherein at least one of the parameters a, b, or c is determined by curve fitting based on a simulation or a measurement.

23. The method of claim 12, wherein the second model equation for a selected pair of contacts is

$$Z = [ay^2 + by + c]e^{-\beta(x-x_a)},$$

wherein Z is a ratio of an open-circuit voltage at a first contact to a source current at a second contact, y is a relative position between the first contact and the second contact, a, b, and c are scalable parameters for the substrate that depend on contact dimensions, x is a separation between the first contact and the second contact, x_a is a value of x used

in determining a, b, and c, and β is a parameter that is dependent on substrate properties.

24. The method of claim 23, wherein a size of the first contact is different than a size of the second contact.

25. The method of claim 23, wherein at least one of the parameters a, b, c or β is determined by curve fitting based on a simulation or a measurement.

26. The method of claim 12, wherein the substrate is a lightly doped substrate, and the second model equation for a selected pair of contacts having a fixed relative position y is

$$Z = \alpha K_0(\beta x),$$

wherein Z is a ratio of an open-circuit voltage at a first contact to a source current at a second contact, K_0 is a 0th-order Bessel function of the second kind, x is a separation between the first contact and the second contact, and α and β are parameters that are dependent on substrate properties.

27. The method of claim 12, wherein the substrate is a lightly doped substrate and the second model equation for a selected pair of contacts predicts a value Z as a function of a separation x between the first contact and the second contact, wherein Z is a ratio of an open-circuit voltage at a first contact to a source current at a second contact, and log(Z) has a linear behavior when x is greater than a certain value and an asymptotic-like behavior when x is less than the certain value.

28. A computer-readable medium storing computer-executable instructions for causing a computer system to perform the method of claim 1.

29. A method of substrate modeling, comprising:

determining scalable parameters associated with at least two substrate contacts, at least one of the scalable parameters being scalable with a contact perimeter;

constructing a matrix of the scalable parameters for the at least two substrate contacts; and

calculating an inverse of the matrix to determine resistance values associated with the at least two substrate contacts.

30. The method of claim 29, wherein the scalable parameters are Z parameters.

31. The method of claim 29, wherein at least one of the scalable parameters is scalable with a contact separation.

32. The method of claim 29, wherein the scalable parameters comprise a first set of scalable parameters associated with resistances between the at least two substrate contacts and a groundplane and a second set of scalable parameters associated with cross-coupling resistances between the at least two substrate contacts.

33. The method of claim 29, wherein the number of contacts is N, and the matrix is an $N \times N$ matrix.

34. A computer-readable medium storing computer-executable instructions for causing a computer system to perform the method of claim 29.

35. A method of substrate modeling, comprising:

determining scalable parameters associated with at least three substrate contacts;

constructing a matrix of the scalable parameters representative of the at least three substrate contacts; and

calculating resistance values associated with the at least three substrate contacts from the matrix.

36. The method of claim 35, wherein the scalable parameters are *Z* parameters.

37. A computer-readable medium storing computer-executable instructions for causing a computer system to perform the method of claim 35.

38. A method for determining a scalable *Z* parameter for a contact in a substrate, wherein the scalable *Z* parameter is associated with a resistance between the contact and a groundplane, the method comprising:

modeling the *Z* parameter as a function of contact area and contact perimeter, the function comprising at least one coefficient that is dependent on properties of the substrate;

obtaining a plurality of sample data points for the *Z* parameter in the substrate, the sample data points being obtained for a range of contact sizes; and

determining values of the multiple coefficients such that the function produces a curve that fits the sample data points.

39. The method of claim 38, wherein the range of contact sizes is from about 2.4 μm to about 100 μm.

40. The method of claim 38, wherein the contacts are square or rectangular.

41. The method of claim 38, wherein at least a portion of the sample data points are obtained from a simulation or a measurement.

42. The method of claim 38, wherein the function is

$$Z = \frac{1}{K_1 Area + K_2 Perimeter + K_3},$$

wherein Z is a ratio of an open-circuit voltage to input current for the contact with all other contacts in the substrate being open circuits, *Area* is the contact area, *Perimeter* is the contact perimeter, and K_1, K_2, and K_3 are coefficients that are dependent on the properties of the substrate.

43. A computer-readable medium storing computer-executable instructions for causing a computer system to perform the method of claim 38.

44. A method for determining a scalable Z parameter for a pair of contacts in a substrate, wherein the scalable Z parameter is associated with a cross-coupling resistance between a first contact and a second contact of the pair of contacts, the method comprising:

modeling the Z parameter as a function of a separation x between the first contact and the second contact, the function comprising multiple coefficients, at least one of the multiple coefficients being dependent on properties of the substrate;

obtaining a plurality of sample data points for the Z parameter, the sample data points being obtained for a range of separations x between the first contact and the second contact; and

determining values of the multiple coefficients such that the function produces a curve that fits the sample data points.

45. The method of claim 44, wherein the first contact and the second contact have a same contact size.

46. The method of claim 44, wherein the range of separations x comprises values of x substantially equal to or greater then 10 μm.

47. The method of claim 44, wherein the range of separations x is from about 10 μm to about 120 μm.

48. The method of claim 44, wherein at least a portion of the sample data points are obtained from a simulation or a measurement.

49. The method of claim 44, wherein the function is

$$Z = \alpha e^{-\beta x},$$

wherein Z is a ratio of an open-circuit voltage at the first contact to a source current at the second contact, α is a value of Z for x_0, and β is a coefficient that is dependent on the properties of the substrate.

50. The method of claim 49, wherein α is determined from

$$\alpha = \frac{1}{K_1 Area + K_2 Perimeter + K_3},$$

wherein *Area* is a combined contact area, *Perimeter* is a perimeter of the combined contact, and K_1, K_2, and K_3 are coefficients that are dependent on the properties of the substrate.

51. The method of claim 50, wherein K_1, K_2, and K_3 are determined by curve fitting α to a plurality of data points obtained for a range of different *Area* and *Perimeter* values.

52. A computer-readable medium storing computer-executable instructions for causing a computer system to perform the method of claim 44.

53. A method for determining a scalable Z parameter for a pair of contacts in a substrate, wherein the scalable Z parameter is associated with a cross-coupling resistance between a first contact and a second contact of the pair of contacts, comprising:

modeling the Z parameter as a function of a relative position y between the first contact and the second contact, the first contact having a greater dimension than the second contact along a y axis, the function comprising multiple coefficients, at least one of the multiple coefficients being scalable with dimensions of the first contact;

obtaining a plurality of sample data points for the Z parameter, the sample data points being calculated for a range of positions y of the second contact relative to the first contact; and

determining values of the multiple coefficients such that the function produces a curve that fits the sample data points.

54. The method of claim 53, wherein the range of positions y is from substantially zero to a length of the first contact along its y axis.

55. The method of claim 54, wherein the plurality of data points are obtained for a contact having an area between about 2.4 μm and 100 μm.

56. The method of claim 53, wherein at least a portion of the sample data points are obtained from a simulation or a measurement.

57. The method of claim 53, wherein the function is

$$Z = ay^2 + by + c,$$

wherein Z is a ratio of an open-circuit voltage at the first contact to a source current at the second contact, y is a relative position between the first contact and the second contact, and a, b, and c are scalable coefficients for the substrate that depend on contact dimensions.

58. The method of claim 57, wherein c is found by:

$$c = \alpha e^{-\beta x_a}$$

wherein α is a value of Z for x_0, β is a coefficient that is dependent on substrate properties, and x_a is a separation between the first contact and the second contact.

59. The method of claim 57, wherein the pair of contacts is an original pair of contacts, and a, b, and c are scaleable for a new pair of contacts by a ratio of α_{new}/α, where α_{new} is a value of α for the new pair of contacts and α is a value of α for the original pair of contacts.

60. A computer-readable medium storing computer-executable instructions for causing a computer system to perform the method of claim 53.

61. A method for determining a scalable Z parameter for a pair of contacts in a substrate, wherein the Z parameter is associated with a cross-coupling resistance between a first contact and a second contact of the pair of contacts, comprising:

modeling the scalable Z parameter as a function of a separation x between the first contact and the second contact and as a function of a relative position y between the first contact and the second contact, the first contact having a greater dimension than the second contact along a y axis, the function comprising multiple coefficients, at least one of the multiple coefficients being scalable with dimensions of the first contact, and at least one of the multiple coefficients being dependent on substrate properties;

obtaining a first set of sample data points for the Z parameter, the first set of sample data points being obtained for a range of relative positions y of the second contact relative to the first contact for a fixed separation x;

obtaining a second set of sample data points for the Z parameter, the second set of sample data points being obtained for a range of separations x for a fixed relative position y of the second contact; and

determining values of the multiple coefficients such that the function produces a curve that fits the sample data points.

62. The method of claim 61, wherein the function is

$$Z = [ay^2 + by + c]e^{-\beta(x-x_a)},$$

wherein Z is a ratio of the open-circuit voltage at the first contact to the source current at the second contact, y is a relative position between the first contact and the second contact, a, b, and c are scalable parameters for the substrate that depend on contact dimensions, x is a separation between the first contact and the second contact, x_a is a value of x used in determining a, b, and c, and β is a coefficient that is dependent on the properties of the substrate.

63. A computer-readable medium storing computer-executable instructions for causing a computer system to perform the method of claim 61.